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Prevalence and Predictors of Potentially Inappropriate Medication Use in Elderly Patients According to Beers Criteria: A Retrospective Study

Anfas Muneeb[1], Muhammad Tausif Khan[2], Ayesha Nawaz[3], Anum Karamat Baig[4], Ezza Khan[5], Hira Nasir[6], Noor Fatima[7]

[1]Pharmacist, Department of Pharmacy Practice, Faculty of Pharmaceutical Sciences, GC University, Faisalabad, Punjab, Pakistan.
[2]Resident Physician, Federal Government, Polyclinic Hospital, Islamabad, Pakistan.
[3]Pharmacist, Department of Pharmaceutical Sciences, Riphah International University, Lahore, Punjab, Pakistan.
[4]Department of Internal Medicine, Jinnah Hospital, Lahore, Punjab, Pakistan.
[5]Pharmacist, Pharma Plus Pharmacy, Pakistan.
[6]Pharmacology Lecturer, Faisal Institute of Science and Management, Pakistan.
[7]Department of Pharmaceutics, Faculty of Pharmaceutical Sciences, Government College University, Faisalabad, Punjab, Pakistan.

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Correspondence to: Anum Karamat Baig, Department of Internal Medicine, Jinnah Hospital, Lahore, Punjab, Pakistan.
Email: anumkaramat4@gmail.com

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ABSTRACT

Background: Elderly patients are particularly vulnerable to adverse drug events due to age-related physiological changes, multimorbidity, and polypharmacy. Potentially inappropriate medications (PIMs), as defined by the Beers Criteria, increase the risk of falls, cognitive impairment, hospitalisation, and mortality. **Objective:** To determine the prevalence and predictors of potentially inappropriate medication use among elderly patients. **Methodology:** This was a hospital-based retrospective observational study conducted at Jinnah Hospital, Lahore, Pakistan from June 2025 to Dec 2025, including 190 elderly patients. **Results:** The mean age was 72.8 ± 6.1 years with 58.9% males. Patients used an average of 6.9 ± 2.3 medications, and polypharmacy was present in 77.9%. PIMs were identified in 84 patients, giving a prevalence of 44.2%, with a mean of 1.7 ± 0.8 inappropriate drugs per affected individual. Benzodiazepines (16.8%), long-term NSAIDs (15.3%), and prolonged proton pump inhibitors (14.2%) were the most common PIMs. Advanced age (OR 2.14), female gender (OR 1.62), multiple comorbidities (OR 2.76), frequent admissions (OR 2.31), and polypharmacy (OR 4.38) were significant predictors. **Conclusion:** It is concluded that potentially inappropriate medication use is common among elderly patients and is primarily driven by polypharmacy and multimorbidity. Regular medication review and deprescribing interventions are recommended to enhance prescribing safety.

INTRODUCTION

The use of medicines in elderly individuals is a distinct clinical issue because of physiological alterations, comorbidity, and common polypharmacy. They have changed the pharmacokinetic and pharmacodynamics of drugs, such as decreased renal and hepatic clearance, and amplified drug sensitivity, which makes the elderly patients especially susceptible to adverse drug reactions and drug-related harm [1]. With the growing life expectancy of the world population, the optimization of prescribing practice of geriatric populations has become the primary concern of contemporary healthcare systems [2]. Polypharmacy, which is defined as a simultaneous intake of five or more drugs, is extremely widespread among older adults and is closely linked with drug-drug interactions, falls, cognitive impairment, hospitalization, and death [3]. The possibility of improper prescription increases with the quantity of medications prescribed particularly among patients with various chronic diseases like hypertension, diabetes, cardiovascular disease, and arthritis [4]. Therefore, medication review ought to be cautious in order to reduce the possible complications that can be avoided [5]. Potentially inappropriate medications (PIMs) are those drugs against which the risks could exceed the benefits in the case of older adults, especially where there are safer or more effective drugs. These drugs can predispose to occurrence of unfavorable events like delirium, sedation, orthostatic hypotension, gastrointestinal bleeding, or renal impairment [6]. The discovery and prevention of PIM use is thus regarded as one of the main quality indicators of prescribing in geriatrics [7].

One of the most commonly used instruments of inappropriate medication usage assessment in older adults is the Beers Criteria developed by the American Geriatrics Society. It gives a list of medications that are not

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preferred or not preferred generally in the elderly with evidence-based information about the list and also information about drug-disease and drug-drug interactions [8]. The criteria have undergone regular revision to indicate the changes in evidence and are widely used in clinical and research practices [9]. Several studies in foreign countries have claimed a high level of PIM among elderly in hospitalized and outpatient settings with a range of 20-60 and above percentages based on the mode of assessment and the setting of the activities [10]. These results demonstrate the size of inappropriate prescribing and its possible effect on patient safety [11]. Exposure to PIM has been linked to higher hospitalization, longer hospitalization, higher healthcare expenses, and worse clinical outcomes [12]. A number of variables have been specified to be predictors of inappropriate use of medication, such as advanced age, female, multiple comorbidity, polypharmacy, impaired cognitive, and a number of prescribers [13]. The prescribing patterns can also be affected by socioeconomic and healthcare system factors, especially in low- and middle-income countries whereby better-organized medication review systems might not be available [14]. Past studies have implied that an understanding of such predictors can be used to address high-risk groups when trying to intervene [15]. However, there is a lack of local data on the prevalence and determinants of PIM use despite the increasing population of the elderly and the increasing medication burden. Knowledge about the degree of inappropriate prescribing in particular clinical environments is necessary to make policy and to guide prescribing, as well as improve patient safety [16].

Objective

To determine the prevalence and predictors of potentially inappropriate medication use among elderly patients.

METHODOLOGY

This was a hospital-based retrospective observational study conducted at Jinnah Hospital, Lahore, Pakistan from June 2025 to Dec 2025, including 190 elderly patients. Participants included patients aged 65 years and above who attended outpatient clinics or were admitted to the medical wards and had complete prescription records available. Patients with incomplete medication data, those admitted for less than 24 hours, terminally ill patients, or those receiving palliative care were excluded to avoid confounding medication patterns.

Data Collection

Data were extracted from patient files and prescription charts using a structured pro forma. Demographic variables included age, gender, residence, and socioeconomic status. Clinical variables included primary diagnoses, number of comorbidities, illness duration, and history of hospital admissions. Medication-related variables included the total number of prescribed drugs, drug classes, duration of therapy, and presence of polypharmacy, defined as the use of five or more medications. Each patient's medication list was evaluated using the latest Beers Criteria to identify potentially inappropriate medications. Drugs were categorised as "avoid," "use with caution," or "drug–disease interaction" according to guideline definitions. The number and type of PIMs per patient were recorded.

Statistical Analysis

Data were entered and analyzed using SPSS version 25. Shapiro–Wilk test was applied to assess normality of quantitative variables. Continuous variables such as age, number of medications, and number of comorbidities were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Prevalence of PIM use was calculated as the proportion of patients receiving at least one inappropriate medication. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 190 elderly patients were included with a mean age of 72.8 ± 6.1 years, showing a predominantly older population. Males constituted 58.9% while females comprised 41.1%. Most participants were urban residents (63.7%). Patients had multiple chronic illnesses with an average of 3.2 ± 1.4 comorbidities and experienced about 1.7 ± 0.9 hospital admissions in the previous year. The mean BMI was 26.3 ± 4.2 kg/m^2.

Table 1

Baseline Demographic and Clinical Characteristics of Elderly Patients (n = 190)

Variable	Category	n (%)	Mean ± SD
Age (years)	Overall	190 (100)	72.8 ± 6.1
Gender	Male	112 (58.9)	73.1 ± 6.3
	Female	78 (41.1)	72.4 ± 5.9
Residence	Urban	121 (63.7)	72.6 ± 6.0
	Rural	69 (36.3)	73.2 ± 6.4
Number of comorbidities	Overall	190 (100)	3.2 ± 1.4
Hospital admissions (past year)	Overall	190 (100)	1.7 ± 0.9
BMI (kg/m^2)	Overall	190 (100)	26.3 ± 4.2

The average number of prescribed medications per patient was 6.9 ± 2.3, indicating a high medication burden. Polypharmacy was highly prevalent, affecting 77.9% of patients who used an average of 8.1 ± 1.8 drugs. Antihypertensives (73.2%) and antidiabetics (51.1%) were most frequently prescribed, followed by NSAIDs (45.3%) and sedatives/benzodiazepines (30.5%).

Table 2

Medication Utilization and Polypharmacy Pattern

Variable	Category	n (%)	Mean ± SD
Total medications prescribed	Overall	190 (100)	6.9 ± 2.3
Polypharmacy	Present (≥5 drugs)	148 (77.9)	8.1 ± 1.8
	Absent (<5 drugs)	42 (22.1)	3.2 ± 0.9
Antihypertensives use	Present	139 (73.2)	1.8 ± 0.7 drugs
Antidiabetics use	Present	97 (51.1)	1.3 ± 0.5 drugs
NSAIDs use	Present	86 (45.3)	1.1 ± 0.3 drugs
Sedatives/benzodiazepines	Present	58 (30.5)	1.0 ± 0.2 drugs

Potentially inappropriate medication use was identified in 84 patients, giving a prevalence of 44.2%, with an average

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of 1.7 ± 0.8 PIMs per affected individual. Drugs categorized as "avoid" were present in 27.4%, while "use with caution" medications occurred in 21.6%, and drug–disease interactions in 12.1%. The overall mean number of PIMs per patient was 0.8 ± 0.9.

Table 3

Prevalence and Types of Potentially Inappropriate Medications (Beers Criteria)

Variable	Category	n (%)	Mean ± SD
At least one PIM	Present	84 (44.2)	1.7 ± 0.8 PIMs
	Absent	106 (55.8)	0.0 ± 0.0
Avoid category drugs	Present	52 (27.4)	1.3 ± 0.5
Use with caution drugs	Present	41 (21.6)	1.2 ± 0.4
Drug–disease interactions	Present	23 (12.1)	1.1 ± 0.3
Total PIMs identified	Overall	190 (100)	0.8 ± 0.9

Benzodiazepines were the most frequent inappropriate medications (16.8%) with prolonged use averaging 7.4 ± 3.1 months. Long-term NSAIDs (15.3%) and proton pump inhibitors beyond recommended duration (14.2%) were also common. Anticholinergics (9.5%), sliding-scale insulin (5.8%), and tricyclic antidepressants (4.7%) were less frequent but clinically significant.

Table 4

Commonly Identified Potentially Inappropriate Medication Classes

Medication Class	Patients Exposed n (%)	Mean Duration (months) ± SD
Benzodiazepines	32 (16.8)	7.4 ± 3.1
NSAIDs (long-term)	29 (15.3)	6.2 ± 2.7
Proton pump inhibitors (>8 weeks)	27 (14.2)	8.6 ± 3.8
Anticholinergics	18 (9.5)	5.9 ± 2.4
Sliding scale insulin	11 (5.8)	4.7 ± 1.9
Tricyclic antidepressants	9 (4.7)	6.1 ± 2.6

Several factors were significantly associated with inappropriate prescribing. Patients aged ≥75 years had more than twice the risk (OR 2.14). Females showed modestly higher risk (OR 1.62). Having three or more comorbidities nearly tripled the likelihood (OR 2.76), while polypharmacy was the strongest predictor with over fourfold increased odds (OR 4.38). Frequent hospital admissions also increased risk (OR 2.31).

Table 5

Predictors of Potentially Inappropriate Medication Use

Variable	PIM Present n (%)	PIM Absent n (%)	Odds Ratio	p-value
Age ≥75 years	39 (56.5)	30 (43.5)	2.14	0.011
Female gender	40 (51.3)	38 (48.7)	1.62	0.048
≥3 comorbidities	58 (57.4)	43 (42.6)	2.76	0.001
Polypharmacy	76 (51.4)	72 (48.6)	4.38	0.001
≥2 admissions/year	34 (60.7)	22 (39.3)	2.31	0.006

DISCUSSION

This retrospective cohort study evaluated the incidence and predictors of the use of potentially inappropriate medication (PIM) in elderly patients and found that the number of inappropriate prescriptions is significant. The age of the study population was 72.8716.1 years old, 58.9 per cent males, and 41.1 per cent females. The patients were also clinically complex with an average of 3.2 + 1.4 comorbidities, and 1.7 + 0.9 hospital admissions per year, which means that patients used healthcare services frequently. Previous studies in geriatric populations have also reported similar age distribution and high multimorbidity [17]. The exposure to medication was high, with the patients taking a mean of 6.9 with a standard deviation of 2.3 medications. Polypharmacy was so common with 77.9 percent of patient taking 8.1 = -1.8 drugs taking a mean of 3.2 = -0.9 drugs being the average drug intake of individuals who do not display polypharmacy. The high number of medications can greatly contribute to the risk of drug interactions and improper prescription. Other past studies also indicate a similar polypharmacy rate of over 70 percent [18]. The general rate of using PIM was 44.2 percent (84/190 patients), and those with it were subjected to 1.7 on average with 0.8 standard errors of inappropriate medications. Avoid category consisted of drugs in 27.4, use with caution category in 21.6 and drug-disease interactions in 12.1. Such results suggest that almost every two older patients had at least one at-risk medication. Other research that has employed Beers Criteria has recorded similar prevalence levels that ranged between 30% and 50% [19].

In the case of specific drug classes, benzodiazepines was the most common PIM (16.8%), with an average 7.4 + 3.1 months of continued use, and long-term NSAIDs (15.3%), long-term proton pump inhibitors (14.2%), past continued usage. Less common and clinically significant were anticholinergics (9.5%), and tricyclic antidepressants (4.7%). Repeated patterns of medication especially sedatives and non-steroid anti-inflammatory drugs have been mentioned as significant contributors to falls and cognitive impairment in past studies [20]. Risk analysis also established that the patients 75 years and above had more than twice the risk of exposure to PIM (OR 2.14), females had slightly more risk (OR 1.62), and patients having 3 or more comorbidities were almost three times more likely to be exposed to PIM (OR 2.76). The frequent hospital admissions also correlated (OR 2.31). It is noteworthy that polypharmacy has become the most powerful predictor, and it raises the risk by more than four times (OR 4.38). A similar correlation between medication burden and inappropriate prescribing has been observed in the past studies [21]. All in all, the findings support the evidence that an inappropriate use of medication is a common occurrence connected to polypharmacy and clinical complexity. A regular review of medication, deprescribing, and the compliance with Beers Criteria may significantly decrease the incidence of avoidable adverse drug events and enhance safety among geriatric patients. This study was limited by its retrospective single-center design, reliance on medical record documentation, and absence of follow-up data on adverse drug reactions or clinical outcomes, which restricts causal interpretation and generalizability.

CONCLUSION

It is concluded that potentially inappropriate medication use is highly prevalent among elderly patients, affecting 44.2% of individuals, and is strongly associated with polypharmacy, multiple comorbidities, advanced age, and frequent hospital admissions. Polypharmacy emerged as the strongest predictor, increasing the likelihood of

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inappropriate prescribing more than fourfold. Regular medication review using Beers Criteria and structured deprescribing strategies are essential to reduce medication-related harm and improve geriatric patient safety.

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